

'Chemical Integrity' of the Great Lakes?

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Summary of the 2004 Chemical Integrity Workshop in Toronto

Chemical Integrity is the capacity to support and maintain a balanced, integrated and adaptive biological system having the full range of elements and processes expected in a region's natural habitat.

- Is Chemical Integrity the capacity to maintain Biological Integrity?

- * What about the capacity to maintain the sustainability of human uses of the habitat?

What Items should be included in Chemical Integrity?

- The current suite of chemicals of concern are declining
- Toxicology information is needed, not just concentrations
- Very weak information on the toxicology of mixtures
- Focus on assessment not monitoring
- How well do we find new chemicals of potential concern ?
- Perturbations (e.g., Invasives, Climate, Land use)

What Items should be included in Chemical Integrity?

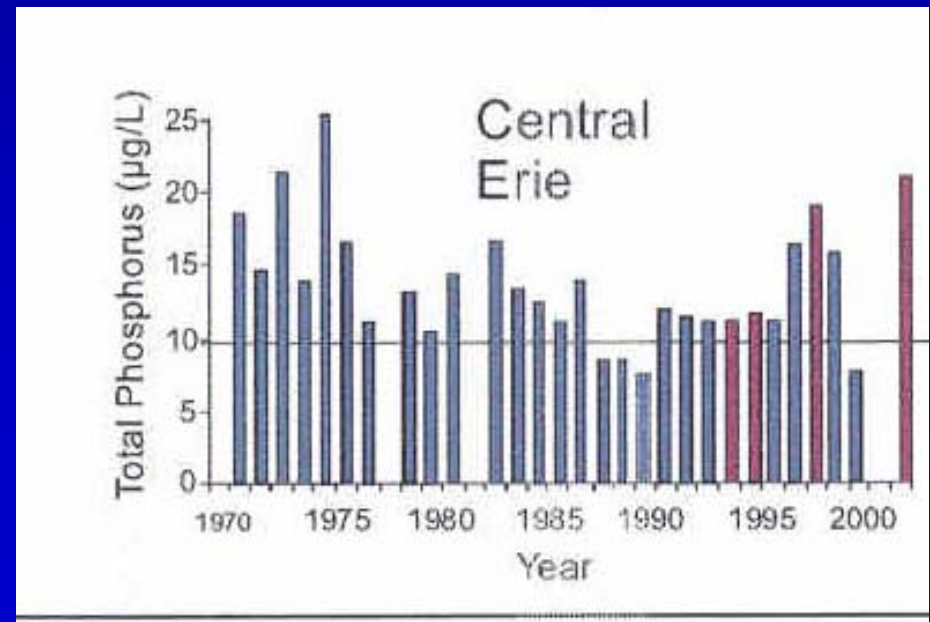
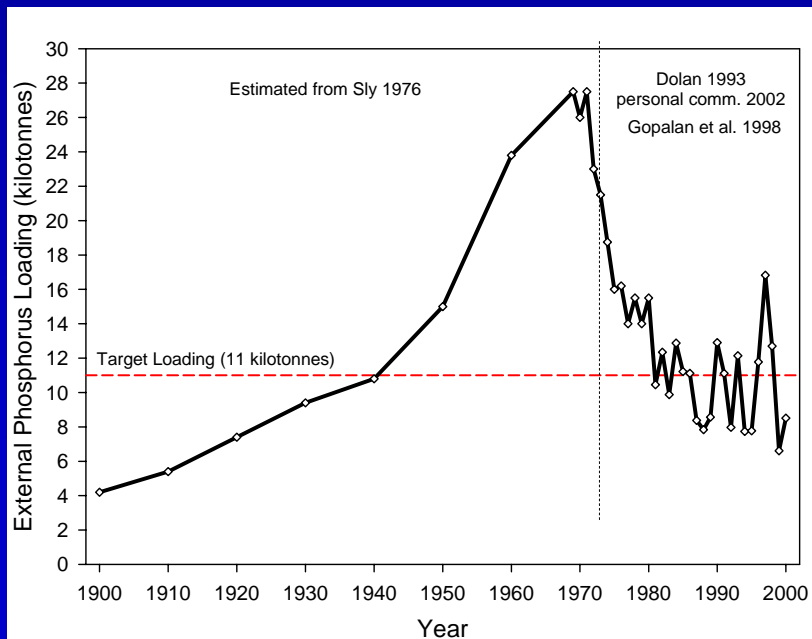
- * Nature of the chemical
 - * Persistence
 - * Toxicity
 - * Quantity/concentration
- * Chemical sources and loadings
 - * Atmosphere
 - * Tributary
 - * Non-point Sources
 - * Point Sources
 - * Internal
- Habitat
 - * Tributary
 - * Wetland
 - * Nearshore
 - * Off-shore
- * Effects on Biological Integrity

What Chemicals are of Concern

Nutrients (P; Nitrate, Fe?)

Phosphorus has generally declined, but:

- P is increasing in the central basin of Lake Erie
- Internal recycling has changed (dreissenids)
- N is increasing everywhere



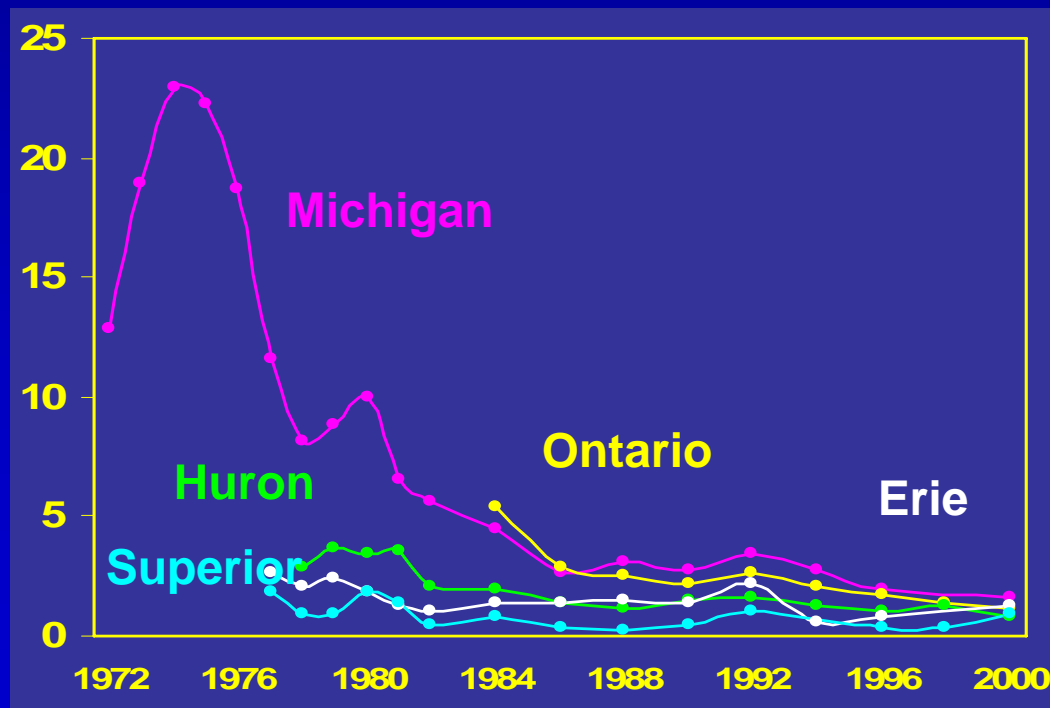
What Chemicals are of Concern - cont

Organic Contaminants (PBTs; pesticides, PCBs, PAHs, dioxins)

PBTs have declined, but:

- some still result in restrictions
- internal reservoirs and recycling may dominate loads
- some controls are beyond the Great Lakes Basin

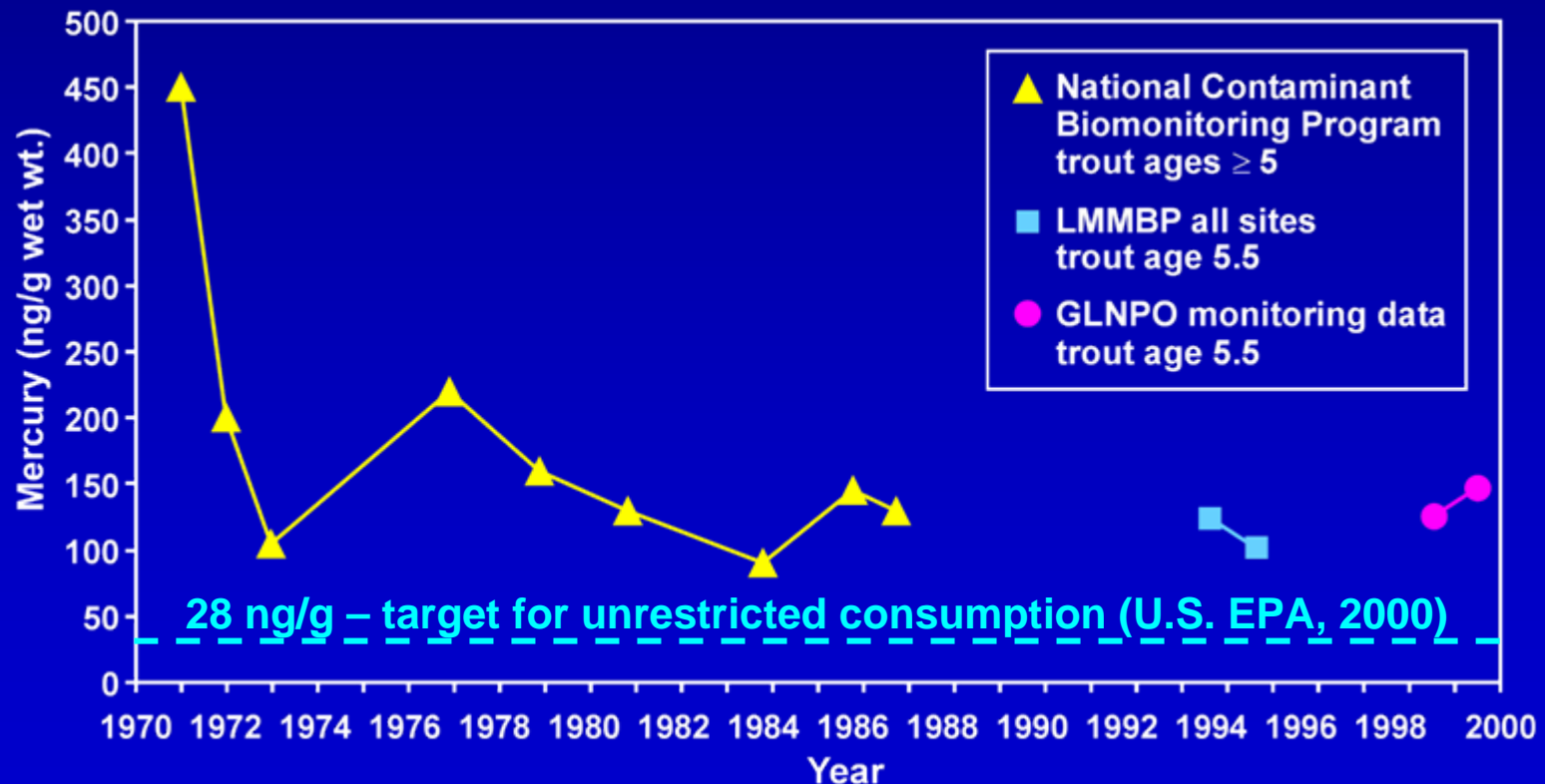
PCBs in Lake Trout (Walleye in Lake Erie)



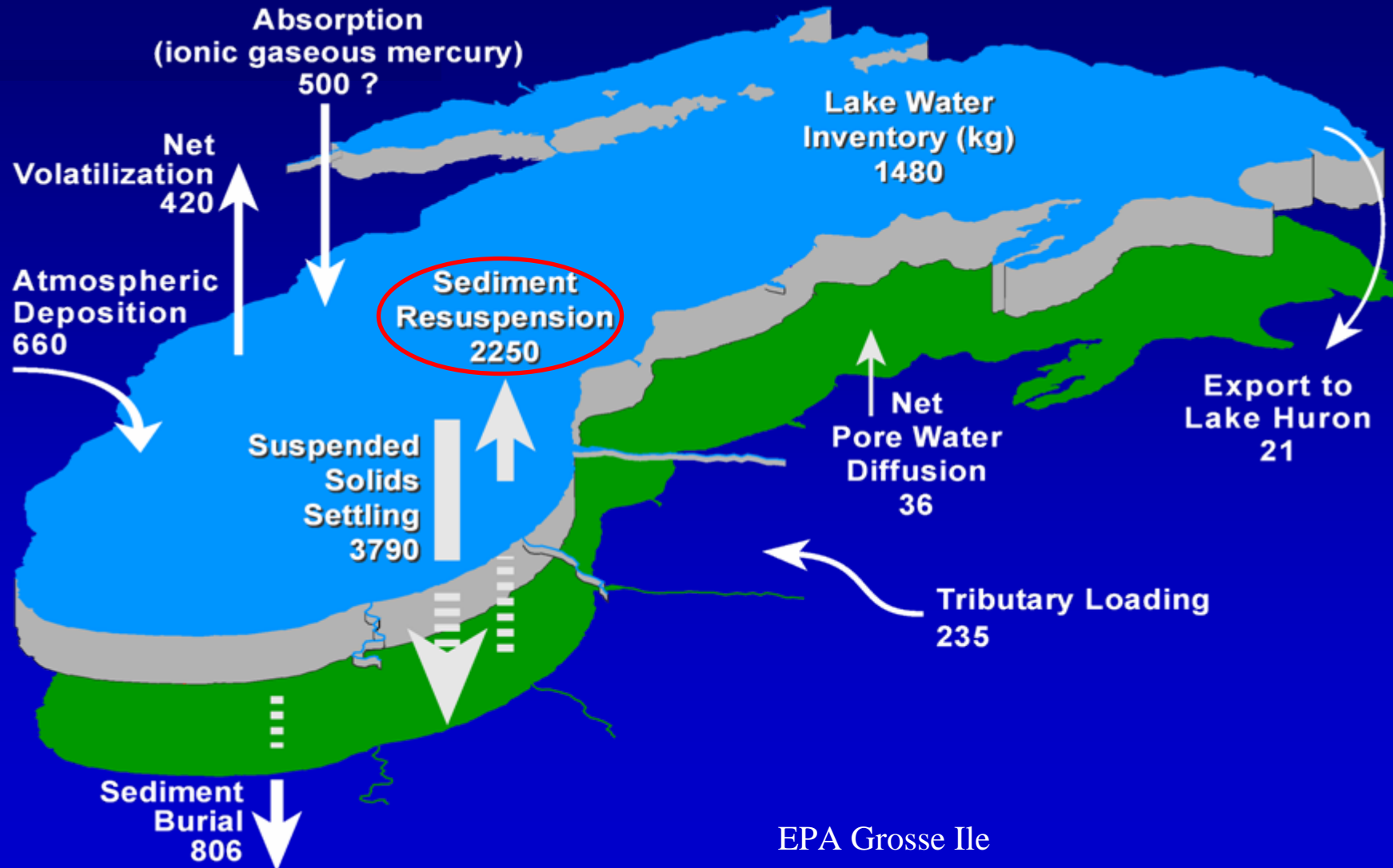
What Chemicals are of Concern - cont

Metals (Hg,[methyl-Hg], Pb, etc.

Total Mercury in Lake Michigan Lake Trout Median of Composites)



Total Mercury Mass Balance for 1994-1995 (Mass Inputs and Outputs in kg/year)



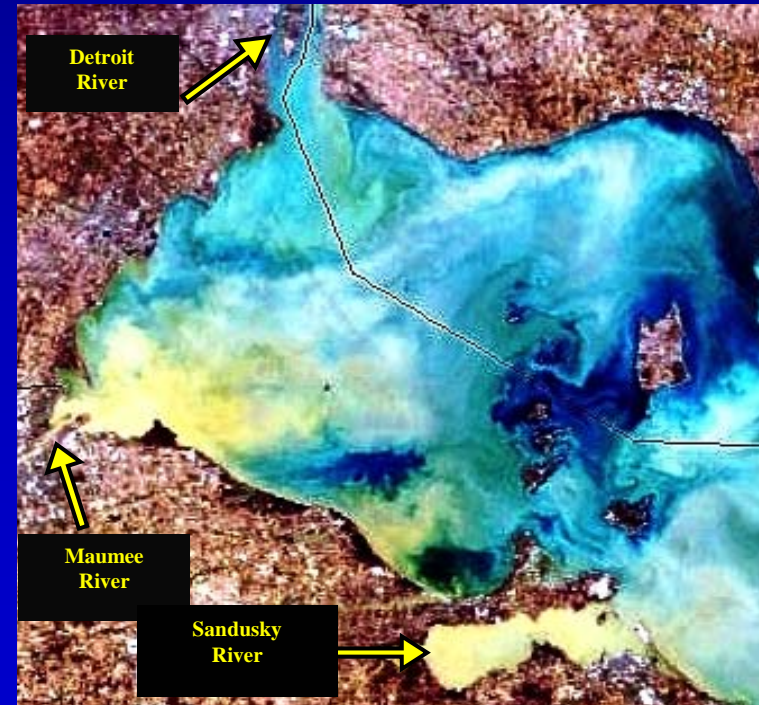
EPA Grosse Ile

What Chemicals are of Concern – cont.

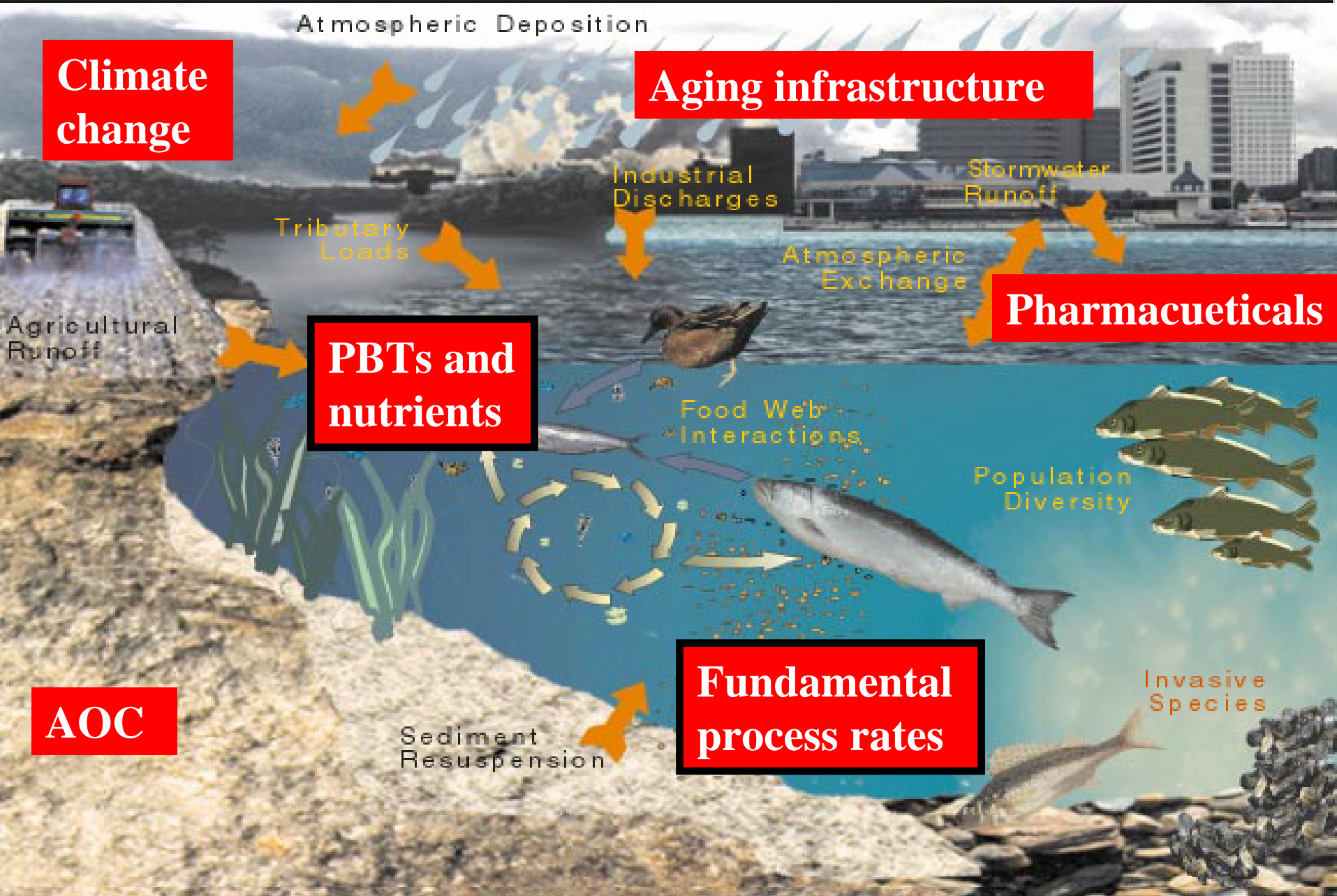
- Taste/Odor
- **HABs (e.g., microcystins)**
- Pharmaceuticals
- Road Salt
- Caffeine / other WWTP discharges
- Biohazards (viruses)
- Medical wastes

Seasonal HABs

High concentrations of toxins
microcystin > 1µg/l

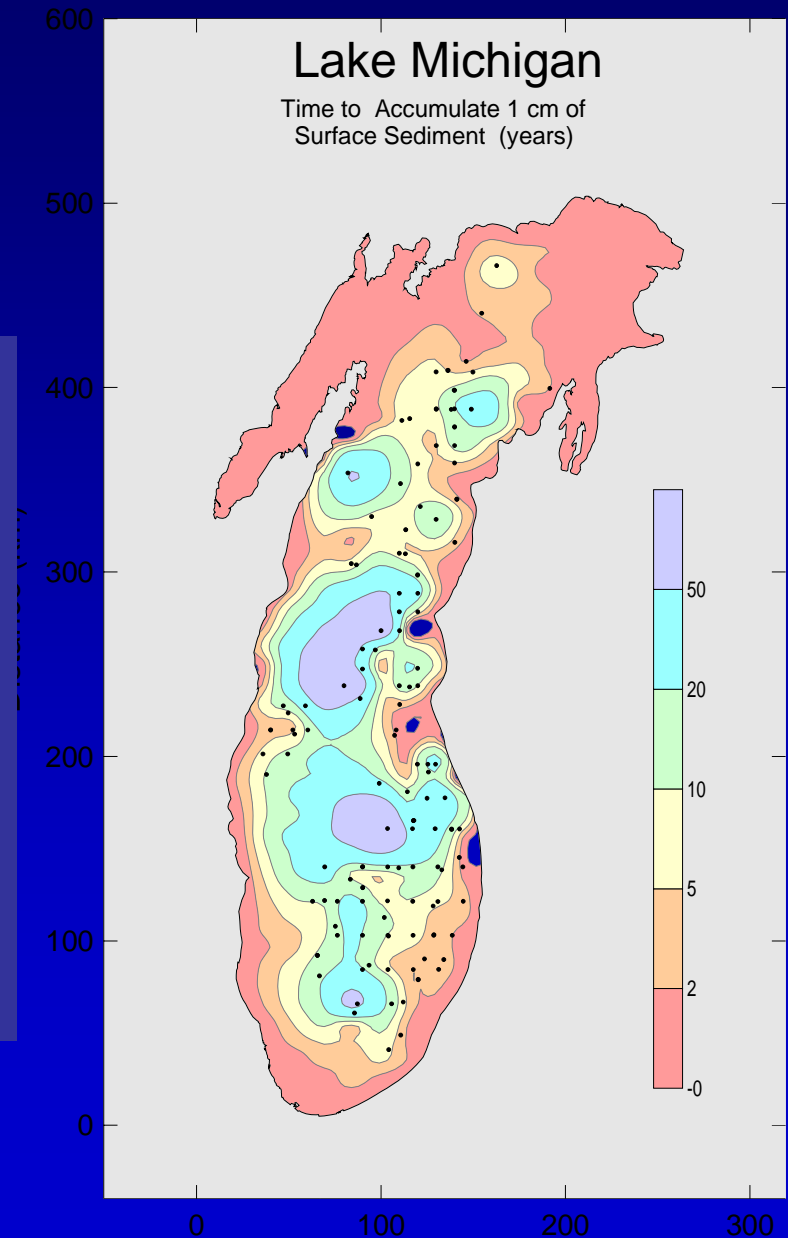
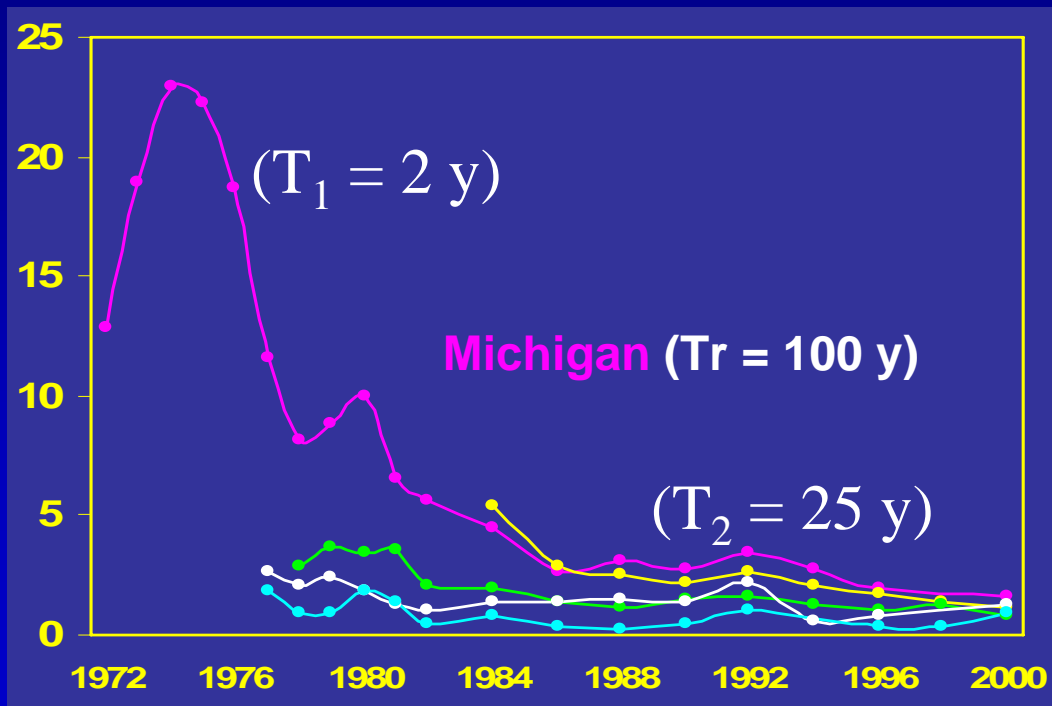


Chemical Integrity of the Great Lakes



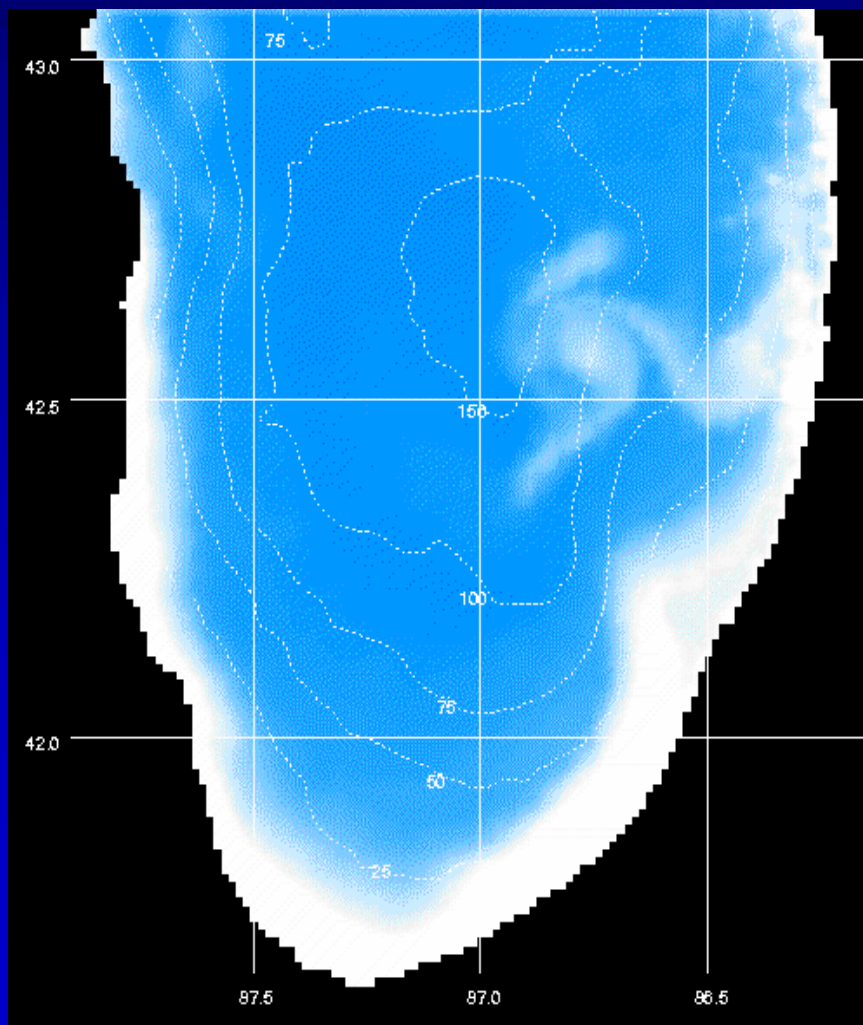
Fundamental information needed for each lake

PCBs in Lake Trout (Walleye in Lake Erie)

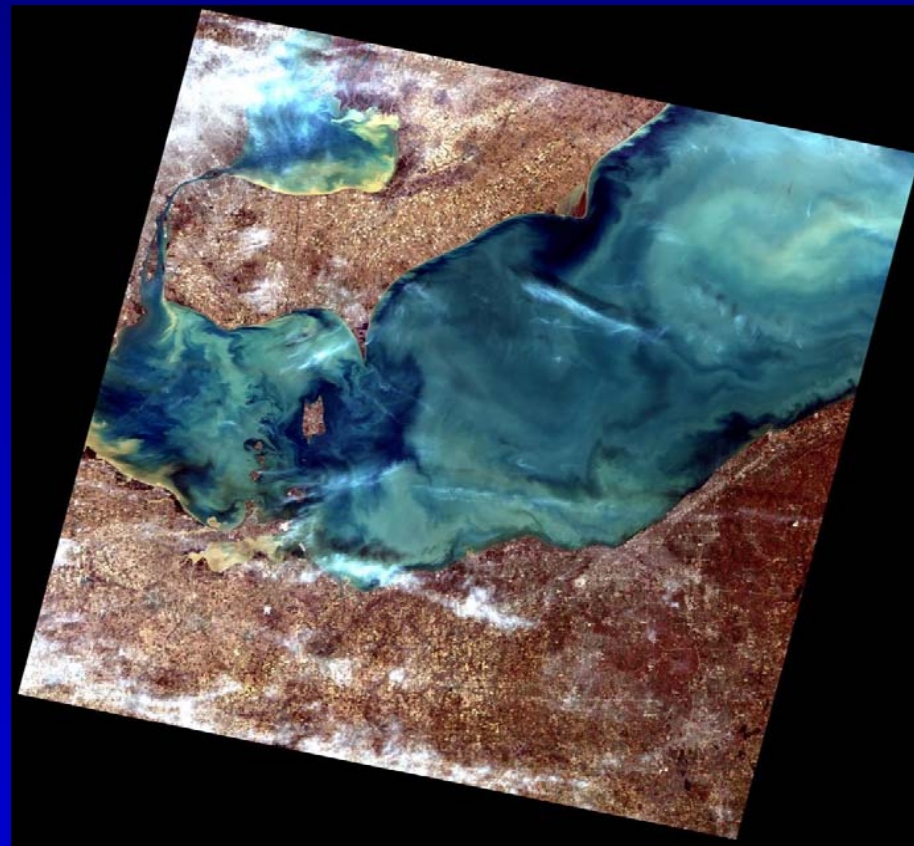


Sediment-water coupling – Legacy chemical contamination

March 12, 1998

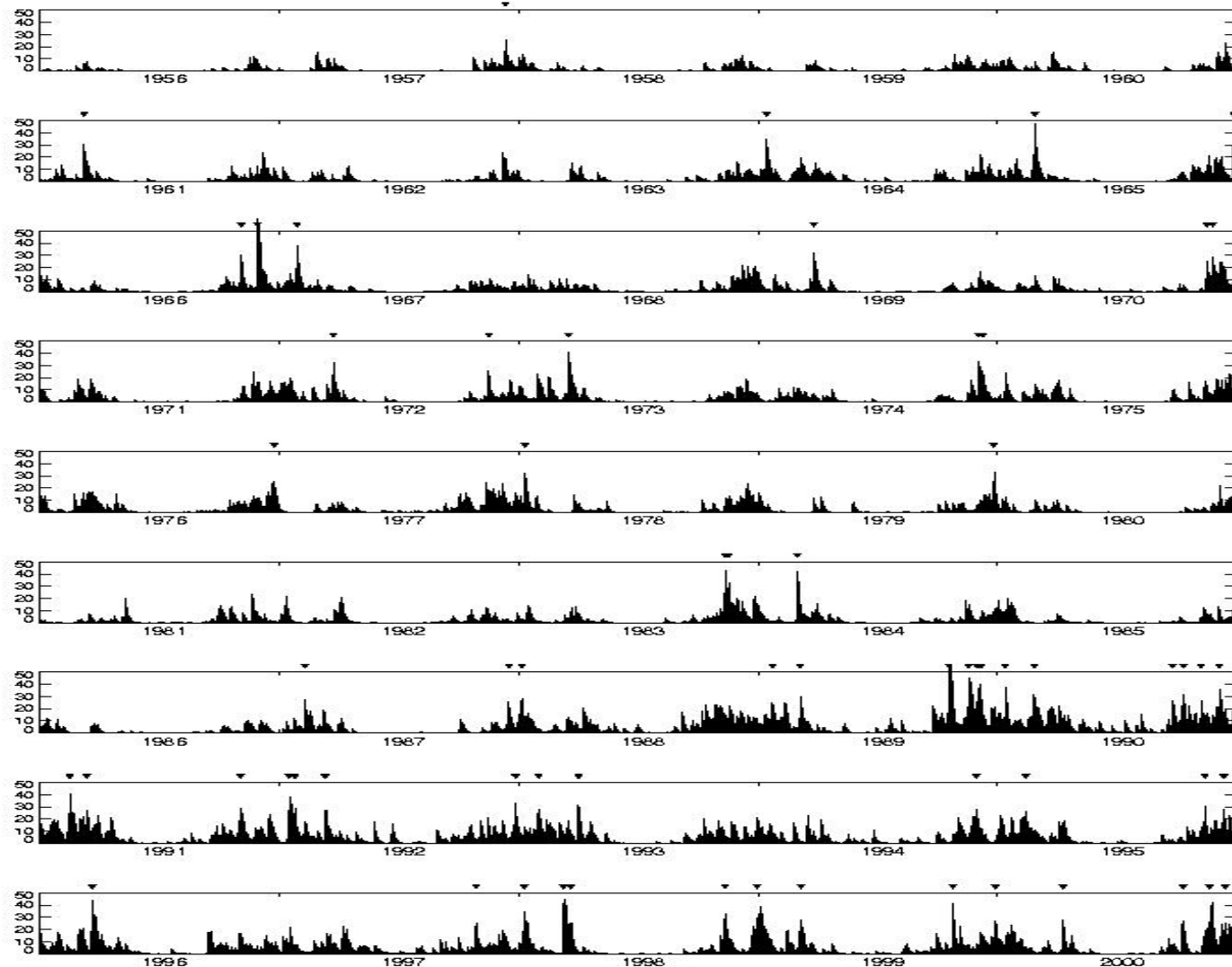


April 11, 2002



Climate Change ?

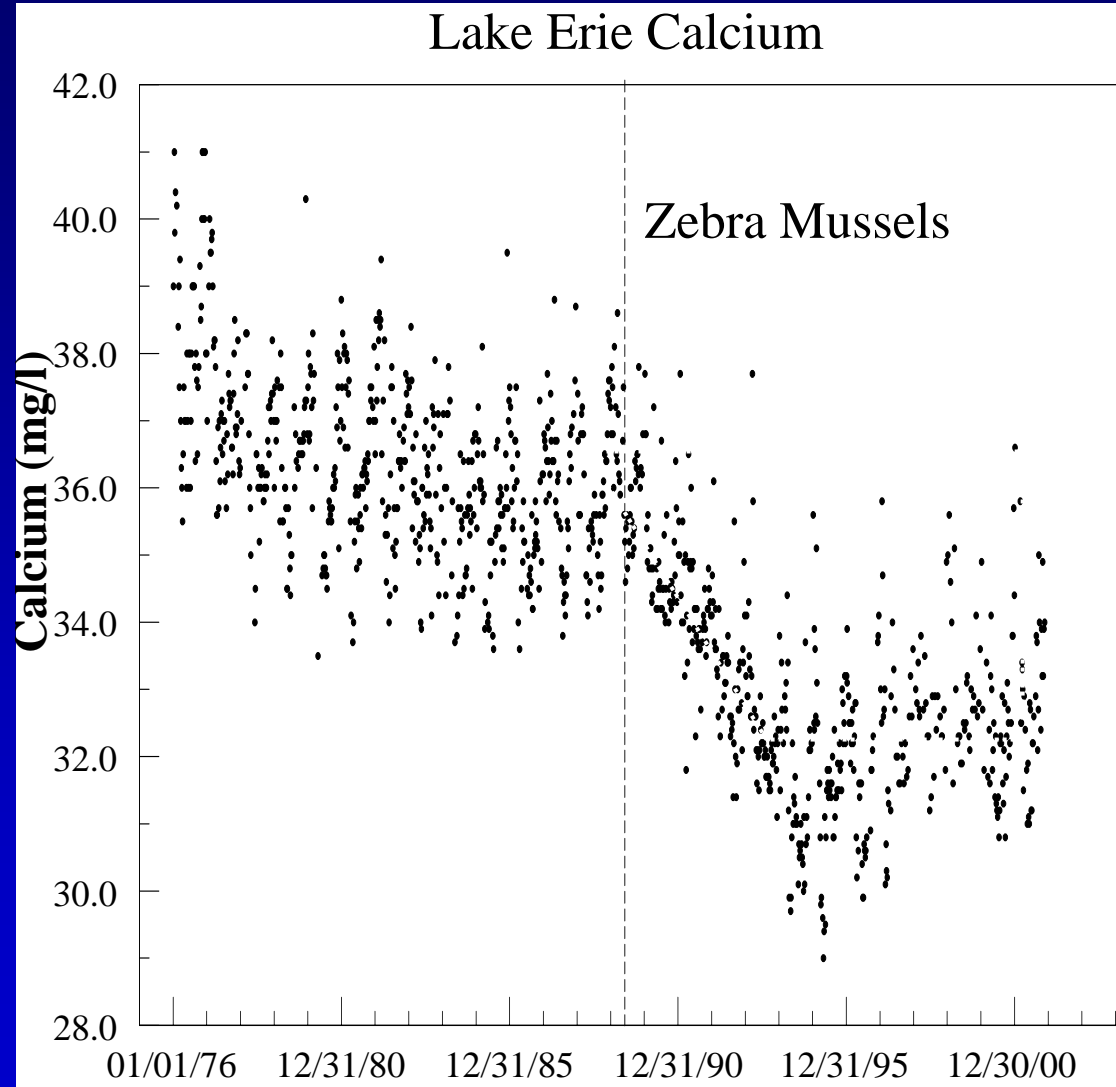
45 Year Hindcast of Southern Lake Michigan Resuspension



One chemical Impact of Zebra mussels

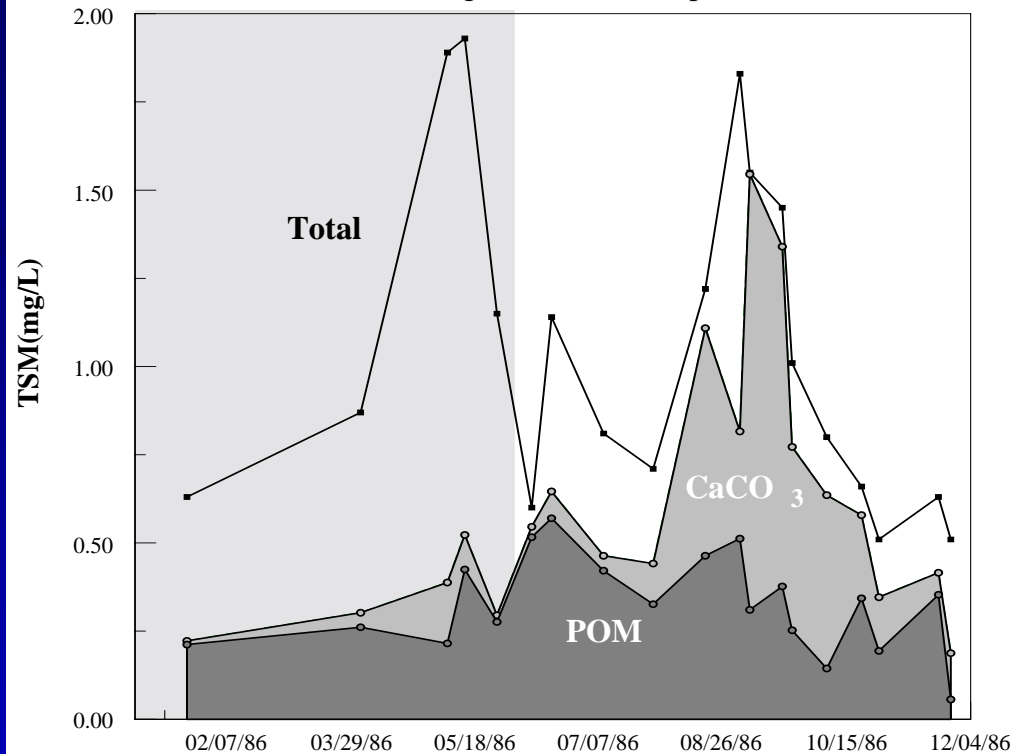


Photo credit: Bay City Times

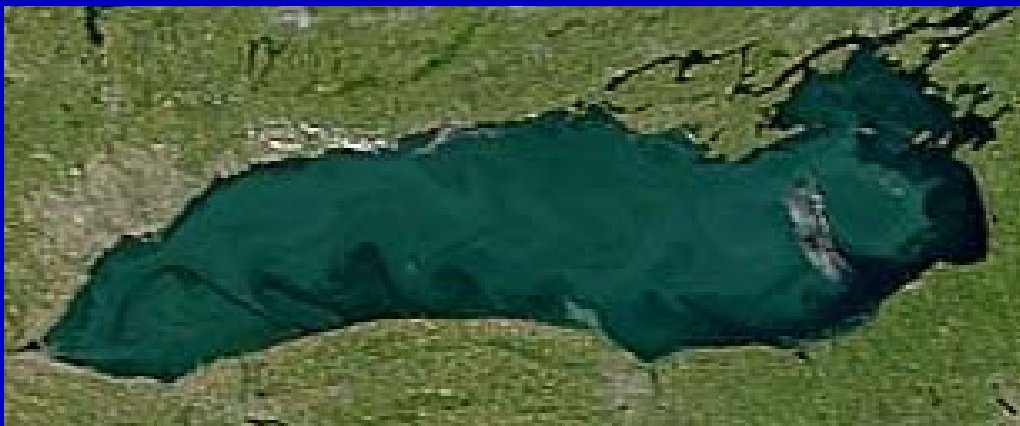


Data: Env Canada

Lake Michigan Particle Composition



'Whiting' Sep 6, 2000



'Whiting' Sep 7, 1999



Summary - Issues relating to Chemical Integrity

PBTs have declined, but some still result in restrictions

Nutrients

P increasing in the central basin of Lake Erie

N is increasing everywhere

Pharmaceuticals – low levels detected – Impacts ?

Impact of Climate Change

Aging infrastructure

Sewage and water treatment facilities

Recruitment and retention of younger Great Lakes scientists

Summary - Issues relating to Chemical Integrity - contuied

Areas of Concern

Constituent loads

Local (Tributary P, pharmaceuticals)

Regional (Combustion products)

Global (Hg, DDT)

Processes → Ecosystem Models

Improving Risk Assessment Tools

Algorithm improvements for satellite imagery

Development of automated observing systems

ACKNOWLEDGEMENTS



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